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The Effectiveness Of Table-Top Exercise Simulation For Hospital Disaster Preparedness Training A Systematic Review

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ABSTRACT

Background: To improve the knowledge and skills of hospital staff and better equip them to the handle unforeseen emergencies, hospitals in Indonesia need a participatory disaster preparedness training model. Media used is a simulation of the tabletop exercise model with the collaborative method using a disaster scenario. This study aims to determine whether current research adequately conceptualizes, describes, and interprets tabletop exercise related to hospital disaster preparedness to account for the effectiveness of the simulations.

Method: This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Six electronic databases were used as sources of information: google scholar, cambridge core, pubmed, proquest, scopus, and science direct. The search terms were "simulation" (tabletop exercise simulation or simulation-based disaster) and "hospital disaster preparedness".

Results: Of the 470 research studies found during the search phase, six met the requirrements to be included in this review. The included six studies showed that tabletop exercise could improve the knowledge and skills of officers in disaster management in hospitals.

Conclusion: Tabletop exercise can help hospital officials become more knowledgeable and competent in crisis management. This tabletop exercise is a creative and useful training tool for hospital disaster preparedness.

Keywords: *Hospital Disaster Preparedness, Simulation, TableTop Exercise*

1. INTRODUCTION

Disasters occur in almost every country in the world, and this fact shows that every country should form a system and carry out preparedness stages to anticipate emergencies. Although the capacity of each country to prepare for disasters varies across all strategies, no country is fully prepared and safe. The Sendai Framework sets goals for disaster risk reduction for 2015 - 2030 and includes the implementation of measures to reduce exposure to hazards and vulnerability to disasters. The government should build a disaster-resistant country or city, map disaster-prone areas, use communication technology during disasters, and build a culture of preparedness. In addition, the government also provides appropriate and accurate emergency solutions when the hospital organization is unprepared for a disaster, so the government's role in maximizing health services when a disaster occurs is very necessary. Establishing a "safe and resilient" hospital is needed as a community asset and maximizing integration in disaster response throughout the community and capacity building through community involvement to take a community-based approach are also needed in disaster management (1–4).

Disasters result in death, disability and mental disorders for many victims. Every year, approximately 90,000 people die in natural disasters, and nearly 160 million people are affected by these disasters worldwide(5). According to the World Health Organization (WHO), the number of deaths due to non-natural disasters (Covid 19 pandemic) as of October 17, 2020, was 1,101,298 people(6). In Indonesia, the data on the death toll as of October 18, 2020, due to non-natural disasters (Covid 19 pandemic) was 12,431 people, and natural disasters were 307 people, so disaster management efforts in Indonesia have become the main priority of the current Government(7). Hospitals have an essential role in all phases of disasters; high awareness of all relevant stakeholders is needed to jointly develop health plans to deal with disaster situations. Especially now, most of the world's population is still enthusiastic and fighting against the Covid 19 pandemic. Therefore, hospitals and all stakeholders and employees prepare themselves for natural, non-natural, and social disasters.

Several studies have shown that hospital activities are directly affected by the occurrence of disasters. Then, the design and preparedness of hospitals must be adequate to face disasters and the recovery process from all types of disasters and emergencies. This can include the willingness to conduct appropriate, rapid simulations, be evaluated, and trained. Most hospitals are not prepared to handle large numbers of patients arriving at the same time in the event of a large-scale disaster. One of the efforts of the health care sector is to quickly coordinate the preparation of hospitals, field hospitals, and pandemic hospitals to meet the surge capacity. The magnitude of the impact of the disaster occurs, it is necessary to make maximum efforts in disaster management to minimize the occurrence of mortality and morbidity in disaster victims(3,8–12). One of the obstacles that are often found in efforts to overcome health problems in hospitals during disasters is the lack of knowledge and skills of hospital staff in dealing with disasters, which has the effect of hampering the health care system.

From several research results, it is very necessary to improve the skills of hospital staff so that they can be competent and better prepared in the event of a disaster. This is according to the research of Martono et al. the results show that the level of disaster preparedness of hospital staff in Indonesia is still low, where 1,341 nurses are unprepared and do not understand their role well at the stage of disaster preparedness and when a disaster occurs(13). A recent study conducted in India reported that the knowledge of hospital staff regarding disaster preparedness and management is still lacking. However, staff attitudes were found to be agreement that there is a need for disaster planning, regular training with in-service training programs, and awareness of officers on the importance of disaster management(14). Research in Ethiopia reported that only 34.8% of health workers had good knowledge and skills about post-disaster management. In addition, it was reported that many hospital staff did not know and clearly understand their role in the workplace during a disaster, so that a method or media was needed to improve the skills of hospital staff(15).

The method of education and training activities to improve knowledge and skills of disaster emergency preparedness in hospital personnel can be done through various disaster preparedness training models that can be broadly combined into two large groups and which test different aspects of an organization and/or disaster emergency preparedness system, namely discussion-based training and operation-based training. These training models can train specific skills or procedures such as triage, evacuation or communication to be able to replicate as closely as possible the response to a real emergency. The disaster emergency preparedness training models are as follows (16):

Tabel 1. Disaster emergency preparedness training model

Exercise category	Exercise type	Exercise features	Exercise objectives
Discussion-based	Seminar	An informal discussion or lecture, designed to orient participants with emergency plans, policies, procedures, and their roles.	To identify improvements (e.g. in evacuation plans) through discussion.
	Workshop	Similar to a seminar but used to build a specific product, such as a draft plan or policy..	To develop multi-year training and exercise plans.
	Tabletop Exercise (TTX)	Facilitate discussion of emergency situation simulations in a relaxed atmosphere.	To assess plans, policies, procedures.
Operation-based	*Drill*	Coordinated supervised activities are typically used to test one specific operation or function within one entity (e.g. an emergency department), usually under time	To test staff training, response times, resources and equipment.

		pressure.	
	Command Post Exercise (CPX)	Exercise and/or validate coordination, command and control between various multi-agency coordination centers, usually conducted from an emergency operations center.	To test and evaluate the capabilities of the emergency response system.
	Full Scale Exercise (FSE)	Multi-agency, multidisciplinary exercise involving functional and field responses.	To test and evaluate key parts of emergency operations interactively over an extended period.

One of the exercise model that can be used to improve the skills of officers is to use tabletop exercise (TTX). Tabletop exercise is an indoor simulation that can test the preparedness of various indicators related to disaster management in hospitals. In general, hospitals conduct field simulations involving all hospital stakeholders, while this TTX simulation uses a training collaboration method known as Three Level Collaboration (3LC) using disaster scenarios, then analyzes the responses and reactions of simulation participants(17,18). Research that discusses disaster simulation in hospitals with the TTX approach is still very limited in Indonesia. Research results on the evaluation of hospitals using the Hospital Safety Index (HSI) instrument show that after being evaluated using the HSI, the hospital has an average score of classification B, which means the hospital can still function in an emergency after a disaster. However, the health care process is not running well because hospital disaster management is not ready and health care facilities are at high risk of damage. Including the lack of knowledge of disaster management among the staff of the three hospitals(19). What about the above description? This article discusses the latest findings to answer the hypothetical question, "is it effective to use tabletop exercise (TTX) as a simulation medium to improve the skills of disaster preparedness staff in hospitals?".

2. METHODS

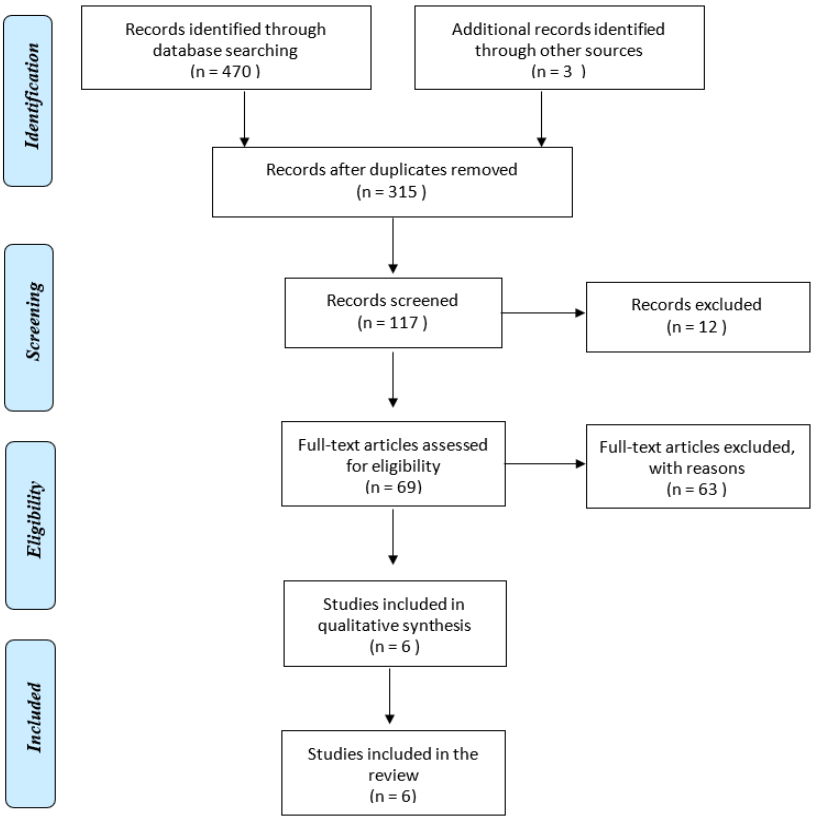
Search strategy

The literature review was conducted using a systematic review method according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Information sources were six electronic databases (google scholar, cambridge core, pubmed, proquest, scopus, and science direct). In the first phase of the database search yielded 1,051 articles. The keywords for the search process consisted of two domains, "simulation" (tabletop exercise simulation OR simulation-based disaster) and "hospital disaster preparedness." Restrictions were placed on peer review and articles in English, so about 470 articles were obtained from the six databases.

Study selection

The researchers searched for titles and abstracts and then filtered them based on inclusion and exclusion criteria. A list of relevant articles was noted, and complete texts from various sources were obtained. Researchers independently assessed articles that met the criteria. The following inclusion criteria were used to select articles as follows:

1. Articles published between 2014 and 2020;
2. Articles in English, since English is the international language used throughout the world;
3. Full-text articles in PDF form;
4. The article discussed the simulation of Tabletop Exercise (TTX) in the Hospital;
5. Articles whose research subjects were hospital staff;
6. Articles whose research locations were in the Hospital environment;



Gambar 1. PRISMA 2009 Flow Diagram(20)

3. RESULTS

Of the 470 articles retrieved through keyword searches in online databases, then using the Mendeley application and duplication of articles, 158 articles were found, leaving 315 articles for further review. The next step in a systematic review was screen the article titles; 198 titles and abstracts were irrelevant because the research focus was not a disaster management simulation activity. Another screening criterion, articles were eligible if published between 2014 and 2020 and in English. Screening results found as many as 117 articles, and articles were excluded from the proceedings and articles according to expert opinion, 12 articles were found, so there were 105 articles. Furthermore, at the feasibility stage, it can meet the criteria if the article was in full-text and PDF form, so it was found that 69 articles were selected for review.

The year of publication of the articles in Figure 2 shows that of the 69 articles that have been reviewed, most were published between 2017 and 2020, as many as 57 articles (82%) and the rest were published between 2014 and 2016, as many as 12 articles (17%) as follows:

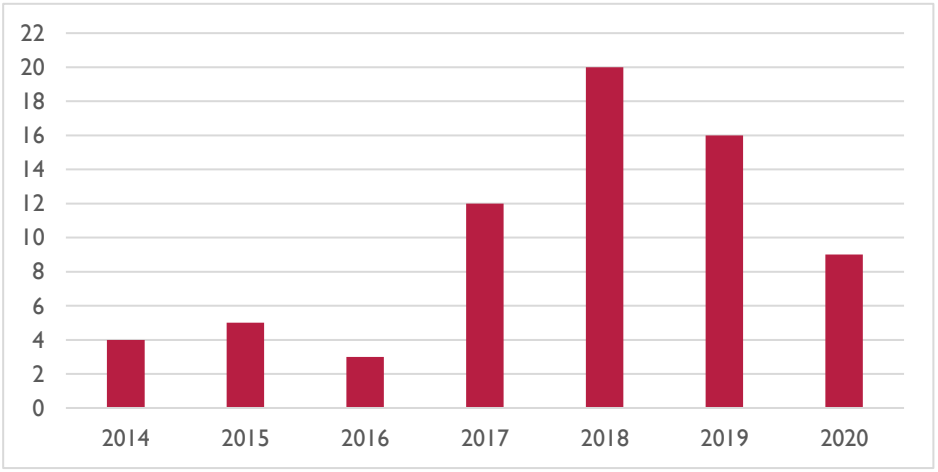


Fig.2 Publication by year (Number of studies reviewed N=69)

The types of disaster threats in table 2 show that almost one-third of the reviewed articles reported results on natural disasters. A large number of articles also focused on simulations or training that tested responses to non-natural disasters (chemicals). Other articles discussed disease outbreaks (COVID-19), emergency disaster evacuations, mass casualty incidents, and bioterrorism.

Table 2. Type of threat analysed in the review

Type of threat	Number of studies (%)
Natural disasters	24 (35%)
Chemical threats	21 (30%)
Pandemic influenza and other infectious diseases	9 (13%)
Emergency evacuation (various threats)	8 (11%)
Mass casuality	5 (7%)
Bioterrorism	2 (3%)

The types of interventions in table 3 show that the most frequently reported disaster emergency exercises are operations-based exercises such as simulations or functional exercises. In addition, the most reviewed research articles are about tabletop exercises (TTX). Other articles are about natural disaster response interventions, large scale command post exercises (CPX) and large scale field exercises (FSE).

Table 3. Type of intervention analysed in the review

Type of intervention	Number of studies (%)
Drill/ functional exercise	36 (52%)
Tabletop exercise (TTX)	21 (30%)
Tabletop+drill/functional exercise	3 (4%)
Natural disaster response	4 (6%)
Large scale Command Post Exercise (CPX)	3 (4%)
Large scale field exercise (FSE)	2 (3%)

After review, 63 articles were excluded because they did not meet the inclusion criteria, articles that conducted disaster management simulations using the tabletop exercise (TTX) model in hospitals, with the research sample being hospital staff. At the end of the search, 6 research articles were selected for review.

Table 4. Research evidence that supports the effectiveness of the Tabletop Exercise simulation in disaster preparedness in hospitals

No.	Research (Author & Year)	Journal	Purpose	Method	Research sample	Finding
1.	Phattharapornjaroen et al. (2020)	Sustainability	Evaluating the increase in knowledge and learning outcomes of Thai EP before and after the 3LC simulation exercise	Quasi Experiment	50 doctors	TTX improves perception ability, knowledge, skills, responsive attitude during large-scale disaster situations and can become a

						leader in emergency management during surge capacity(21).
2.	Achatz et al. (2020)	European Journal of Trauma and Emergency Surgery	Collect content, questions, suggestions, and practice if necessary hospital treatment for victims of social disasters (acts of terror)	Action Research	264 hospital staff	TTX teaches decision-making algorithms and prepares hospital staff for disaster situations(22).
3.	Watson et al. (2020)	Research in Social and Administrative Pharmacy	Evaluating the use of TTX in disaster preparedness of pharmacists and hospital pharmacy staff	Quantitative survey design Pre and Post Study	41 hospital pharmacy	TTX increased understanding of disaster management, where 87.8% of participants stated that they understood their role during a disaster(23).
4.	Davidson et al. (2019)	European Review For Medical and Pharmacological Sciences	Investigating how to handle surge capacity after a non-natural (chemical) disaster	Action Research	20 hospital employees and 25 respondents from 11 countries	TTX can discuss and find joint solutions regarding hospital preparedness plans, triage, surge capacity, and communication strategies during disasters(24).
5.	Mirzael et al. (2019)	Journal of Holistic Nursing and Midwifery	Comparing lecture and TTX methods on nurse preparedness in natural disaster management	Quasi-Experimental Study	74 nurses of Hospitals in Yazd City, Iran	TTX positively affects nurse readiness and is the most effective method because it has a scenario, so participants interact during the simulation(25).
6.	Khan K. (2018)	Health Science Journal	Evaluating the effectiveness of TTX in improving the triage skills of medical personnel in the ER at Hamad General Hospital	Randomized Controlled Trial (RCT)	52 doctors and 54 nurses of emergency room	TTX related to triage showed an increase in triage skills of ED medical staff by about 20-30% compared to written instruction techniques(26).

Six studies describing the simulation of tabletop exercise disasters in hospitals were included. Two types of data sources had been used: direct data sources is surveys and indirect data sources is observations and simulations. The included study shows that tabletop exercise can improve the knowledge and skills of hospital disaster management officials. Table 1 shows the relevant studies, showing that 6 studies were showed that the use of TTX as a simulation medium is very effective in improve the knowledge and skills of hospital disaster preparedness staff. This literature review was not limited by the presence or

absence of disaster scenarios and research methods (research design, location, sampling techniques, instruments, and research findings) (Table 4).

4. DISCUSSION

The results of this literature review show that the use of TTX can streamline disaster preparedness efforts in hospitals. The advantages of using TTX as a disaster simulation are that it is cost-effective, easy to use, applicable, effectively shapes teamwork according to roles and functions(27,28). In addition, TTX simulation is recognized by the World Health Organization (WHO) as a way to help develop, assess, and test the capabilities of health systems and practitioners in disaster emergencies and surge capacity management. The TTX design follows WHO guidelines and includes scenarios developed according to the type of disaster in each region(23,29). TTX simulation is a low-pressure learning experience, where each participant has a role, sits around a table for a simulation, and uses the knowledge of each participant to solve problems or obstacles based on disaster scenarios(16,30,31). The TTX is also easily integrated into educational curricula and effectively provides disaster response training for medical workers. TTX simulation as an educational tool to foster collaborative practice(29,32–34).

Phattharapornjaroen et al. found that the TTX simulation was used to anticipate surge capacity. It also maximizes effective leadership in dealing with large-scale disasters. Fifty doctors participated in this simulation, divided into 3 teams, namely the pre-hospital team, the hospital team, and the hospital incident command team, and there were 3 disaster scenarios, namely terror attacks (bomb explosions), major chaos, and building fires. The scenarios were discussed together in the room, and then participants played their respective roles. The results of this TTX simulation show that physicians experience an increase in their perceptual abilities(21). The results of Noh J & Chung HS show that TTX has a positive effect on improving teamwork and team skills in disaster management(35).

A similar study was conducted in four states (Lowa, Kansas, Missouri, and Nebraska), where virtual TTXs were conducted with pediatric physician participants to improve their knowledge and skills in pediatric emergency preparedness. The findings from this study were that virtual TTXs helped participants clarify roles and responsibilities, facilitated knowledge transfer across sectors, and identified challenges at each level of the disaster response system. In addition, participants reported a largely positive and engaged experience and marked increases in knowledge and confidence in pediatric disaster response. Virtual TTXs are limited in scope because they often require in-person participation or fail to consider at-risk populations. Half-day pediatric virtual TTXs are feasible and effective in promoting pediatric emergency preparedness skills and interprofessional collaboration. With appropriate attention to potential barriers to deployment and sustainability, such exercises could enhance local preparedness capacity and better protect the nation's children during crises (36-40).

5. CONCLUSION

This paper shows that using the TTX model simulation is very effective in improving the skills of officers during a disaster situation. Although research conducted in Indonesian hospitals is still very limited, this paper has clarified that selecting appropriate and accurate intervention media to improve disaster preparedness is very important. This TTX simulation is an innovative and practical training strategy in disaster preparedness.

6. SUGGESTION

We suggest conducting a cohort study to observe whether the skills and role-playing according to the competence of each hospital officer during a disaster situation can be carried out optimally? We acknowledge the limitations of this review, which is not in-depth in discussing the constraints and challenges in implementing this TTX model simulation, which is very closely related to hospital disaster preparedness indicators.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare

Findings Sources

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Author Contributions

All authors contributed substantially to the conception and design, acquisition of data, and analysis and data interpretation; drafting the article; critically revising and approval final version to be published.

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